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Case Report

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# CHRONIC SKULL OSTEOMYELITIS DUE TO PSEUDOMONAS AERUGINOSA IN A DIABETIC PATIENT

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## ABSTRACT

**Background:** Chronic skull osteomyelitis constitutes a rare infection which presents a severe health risk to people who have weakened immune systemse specially to those who have diabetes mellitus. The disease manifests through mild symptoms which result in delayed identification of the condition. Pseudomonas aeruginosa functions as a common pathogen which causes chronic infections because of its ability to withstand treatment. **Case Presentation :** A 58-year-old male patient who had diabetes mellitus under poor management presented with expanded right parietal scalp swelling which caused him pain and showed intermittent pus discharge. The laboratory tests showed leukocytosis together with increased inflammatory markers and the patient had poor glycemic control which showed an HbA1c level of 9.8 percent. The CT and MRI imaging tests showed osteolytic bone lesions that had destroyed cortical bone and produced marrow edema which doctors used to diagnose chronic osteomyelitis. The microbiological testing of pus showed Pseudomonas aeruginosa as the confirmed organism. The medical team treated the patient with intravenous piperacillin–tazobactam followed by a transition to oral ciprofloxacin and they performed surgical debridement of necrotic bone while maintaining strict blood sugar control through insulin therapy. **Conclusion:** Chronic skull osteomyelitis requires a high index of suspicion, especially in diabetic patients. Early diagnosis, culture-guided antibiotic therapy, surgical intervention, and optimal glycemic control are critical for successful management and prevention of complications, leading to favorable clinical outcomes.

**KEYWORDS:** Chronic skull osteomyelitis; *Pseudomonas aeruginosa*; Diabetes mellitus; Surgical debridement; Antibiotic therapy; Case report.

## INTRODUCTION

Chronic osteomyelitis describes a persistent bone infection which presents challenges for both diagnosis and treatment. The condition becomes more severe and less common when it affects the skull because of its relationship to essential brain structures.[1] The condition starts to develop at a slow pace which makes its early symptoms difficult to identify. Patients typically show minor scalp symptoms which include pain and swelling and discharge that doctors often mistake for common skin infections. Doctors find it hard to diagnose this condition because its symptoms show up in mild form. Early identification of the infection is vital because untreated infections can advance to serious medical

issues which affect deeper body tissues and nearby anatomical regions.[2]

Bone tissue in the skull normally resists infection but various factors can create situations which lead to its susceptibility. Infections can extend from nearby regions which include the ear and sinuses and from incidents of trauma and surgical procedures. Bacteria sometimes enter the body through minimal openings or skin diseases and they eventually reach the bone.[3] Dead bone tissue formation creates sequestrum in chronic infections which serves as a bacterial reservoir and makes treatment more difficult. The infection may continue for several months when people do not receive appropriate medical attention. Understanding the disease progression enables doctors to recognize initial symptoms and implement necessary medical treatments.[4]

The development of chronic osteomyelitis is most strongly linked to diabetes mellitus which stands as a major risk factor. High blood sugar levels weaken the immune system while blood supply reductions and wound healing delays enable infections to develop and spread. The risk of developing rare and serious infections increases for patients who have diabetes that remains uncontrolled.[5] The body of these individuals will experience deeper health problems which will result from their minor injuries or infections. Proper blood sugar control serves two purposes: it maintains your health and protects you from bone infection complications. Diabetic patients require continuous monitoring together with prompt medical assistance to address their condition.[6]

Pseudomonas aeruginosa stands as a major bacterial pathogen which causes bone infections in both chronic and hospital-acquired infection situations. The organism possesses the ability to endure extreme environments while simultaneously demonstrating resistance against most standard antibiotics, which complicates treatment efforts. Infections caused by this organism are common among immunocompromised patients, which includes those who have diabetes.[7] The aggressive characteristics of the bacteria require extended treatment with strong antibiotics while surgeons remove infected tissue when needed. The case report presents the clinical characteristics and diagnostic methods along with the successful treatment of chronic skull osteomyelitis which developed through Pseudomonas aeruginosa infection in a diabetic patient.[8]

## CASE PRESENTATION

### Patient Demographics

A 58-year-old male presented to the outpatient department with complaints of swelling over the right side of the scalp. The patient was a resident of a semi-urban area in Andhra Pradesh, India, and belonged to a middle socioeconomic status.

### History of Present Illness

The patient reported a gradually progressive swelling over the right parietal region for the past three months. Initially small in size, the swelling increased gradually and was associated with dull, continuous pain. Over the last four weeks, the patient noticed intermittent purulent discharge from a sinus opening over the swelling. The discharge was yellowish, foul-smelling, and occasionally blood-stained. He also experienced low-grade fever, malaise, and generalized weakness. There was no history of seizures, vomiting, visual disturbances, or altered sensorium.

### Past Medical History

The patient was a known case of type 2 diabetes mellitus for 12 years. His glycemic control was poor due to irregular medication adherence and lack of regular follow-up. There was no history of hypertension, tuberculosis, chronic kidney disease, or any immunocompromised state. He had no prior history of osteomyelitis or chronic infections.

### Medication History

The patient had been prescribed oral hypoglycemic agents (metformin and glimepiride) but reported irregular usage over the past year. He had not been on insulin therapy prior to this admission. There was no history of prolonged antibiotic use, steroid therapy, or immunosuppressive drugs.

### Allergy History

No known drug allergies or food allergies were reported.

### Family History

There was no significant family history of diabetes complications, chronic infections, or malignancies.

### Social History

The patient was a non-smoker and did not consume alcohol. His dietary pattern was mixed. Personal hygiene was average, and there was no history of substance abuse. He lived with his family and had adequate caregiver support.

### Occupational History

The patient worked as a manual laborer, which involved moderate physical activity. There was no occupational exposure to chemicals, toxins, or environments predisposing to infection.

### Physical Examination

### General Examination

- The patient was conscious, alert, and oriented
- Moderately built but poorly nourished
- No pallor, icterus, cyanosis, clubbing, or edema
- Vital signs:
  - Temperature: 99.2°F
  - Pulse: 88 beats/min
  - Blood Pressure: 130/80 mmHg
  - Respiratory Rate: 18 breaths/min

**Local Examination**

- Site: Right parietal region of the scalp
- Swelling size: Approximately 5 × 4 cm
- Shape: Irregular
- Surface: Smooth with overlying erythema
- Temperature: Slightly raised locally
- Tenderness: Present
- Sinus: Single discharging sinus with purulent exudate
- No crepitus or fluctuation noted

**Systemic Examination**

**Central Nervous System (CNS)**

- Higher mental functions: Normal
- Cranial nerves: Intact
- Motor and sensory systems: Normal
- No signs of meningeal irritation or focal neurological deficits

**Cardiovascular System (CVS)**

- S1 and S2 heard normally
- No murmurs or added sounds

**Respiratory System (RS)**

- Bilateral air entry present
- No adventitious sounds

**Abdominal Examination**

- Abdomen soft and non-tender
- No organomegaly
- Bowel sounds present
-

**Laboratory Investigations.**

| Parameter | Patient Value | Normal Range | Interpretation |
|---|---|---|---|
| **Hemoglobin (Hb)** | 11.2 g/dL | 13–17 g/dL | Mild anemia |
| **Total Leukocyte Count (TLC)** | 13,500 cells/mm³ | 4,000–11,000 cells/mm³ | Elevated (infection/inflammation) |
| **Neutrophils** | 78% | 40–70% | Neutrophilia |
| **Lymphocytes** | 18% | 20–40% | Slightly reduced |
| **Platelet Count** | 2.8 lakh/mm³ | 1.5–4.0 lakh/mm³ | Normal |
| **Erythrocyte Sedimentation Rate (ESR)** | 65 mm/hr | <20 mm/hr | Markedly elevated |
| **C-Reactive Protein (CRP)** | 42 mg/L | <6 mg/L | Elevated |
| **Fasting Blood Glucose (FBG)** | 186 mg/dL | 70–110 mg/dL | Elevated |
| **Postprandial Blood Glucose (PPBG)** | 264 mg/dL | <140 mg/dL | Elevated |
| **HbA1c** | 9.8% | <5.7% | Poor glycemic control |
| **Blood Urea** | 28 mg/dL | 10–40 mg/dL | Normal |
| **Serum Creatinine** | 0.9 mg/dL | 0.6–1.2 mg/dL | Normal |
| **Sodium ($Na^+$)** | 138 mEq/L | 135–145 mEq/L | Normal |
| **Potassium ($K^+$)** | 4.2 mEq/L | 3.5–5.0 mEq/L | Normal |
| **Chloride ($Cl^-$)** | 102 mEq/L | 98–106 mEq/L | Normal |
| **Pus Culture** | *Pseudomonas aeruginosa* | No growth | Pathogen identified |
| **Antibiotic Sensitivity** | Sensitive to piperacillin-tazobactam, ceftazidime, ciprofloxacin | — | — |

**Radiological Findings**

**Computed Tomography (CT) Findings**

Non-contrast computed tomography (CT) of the skull revealed an irregular osteolytic lesion involving the right parietal bone. There was evident cortical destruction with areas of sequestrum formation, consistent with a chronic infective process. The lesion margins were ill-defined, and mild adjacent soft tissue swelling was observed. No evidence of intracranial extension, hemorrhage, or calcification was noted.

**Magnetic Resonance Imaging (MRI) Findings**

Magnetic resonance imaging (MRI) of the brain demonstrated altered signal intensity within the right parietal bone. The affected region appeared hypointense on T1-weighted images and hyperintense on T2-weighted and STIR sequences, indicating bone marrow edema and inflammatory changes. Post-contrast images showed enhancement of the involved bone and surrounding soft tissues, suggestive of active infection.

There was no evidence of intracranial extension, dural involvement, abscess formation, or venous sinus thrombosis.

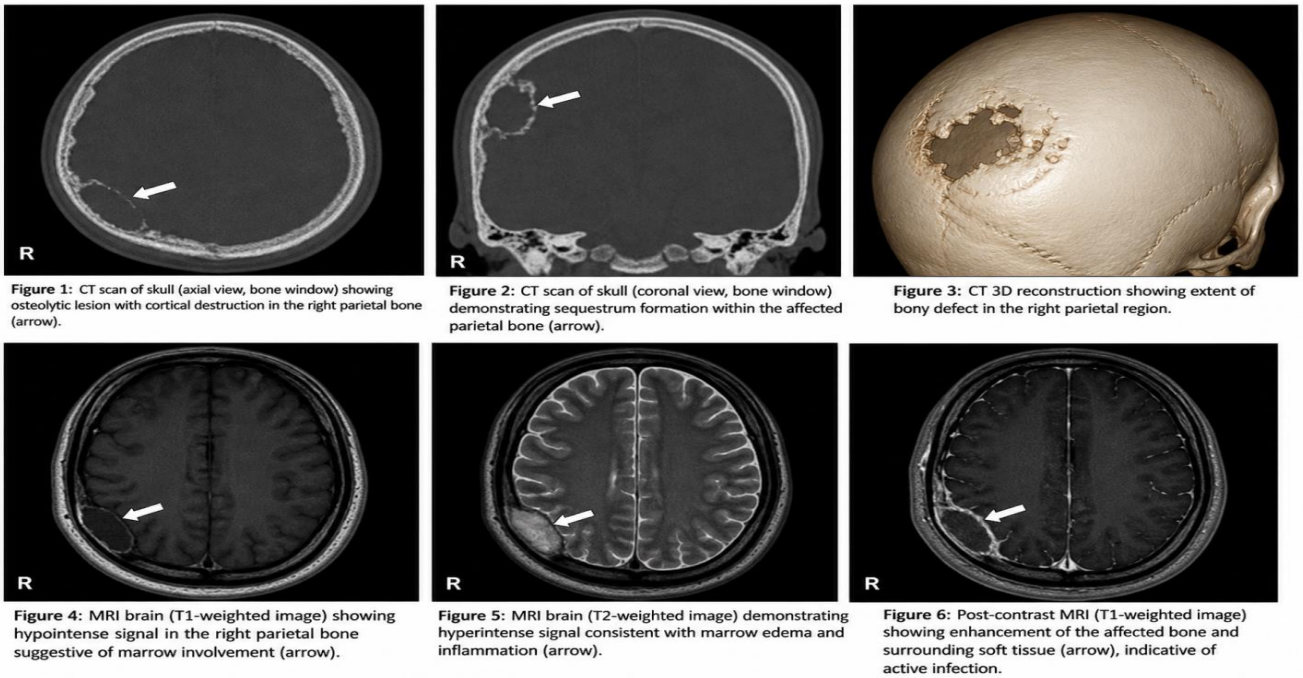


**Figure 1: Radiological Findings.**

## DIAGNOSIS

Based on the patient's clinical presentation, test results, imaging examinations, and microbiological confirmation, the diagnosis of chronic skull osteomyelitis affecting the right parietal bone was made. A persistent infectious process was clearly suggested by the existence of systemic symptoms such low-grade fever, a discharging sinus, and a swollen, painful scalp. Diabetes mellitus that was poorly managed was a major risk factor. Leukocytosis, high ESR, and elevated CRP were found in laboratory tests, indicating persistent inflammation. The diagnosis was further confirmed by radiological evidence of osteolytic lesions with cortical destruction and sequestrum development. Pus culture provided definitive proof of chronic bacterial osteomyelitis by identifying Pseudomonas aeruginosa as the causative organism

## TREATMENT AND MANAGEMENT

**Day 1:** On admission, the patient was started on empirical intravenous antibiotic therapy with piperacillin–tazobactam 4.5 g every 8 hours, considering the likelihood of gram-negative infection, especially Pseudomonas aeruginosa. Baseline investigations and imaging were performed. Due to poorly controlled diabetes (HbA1c 9.8%), insulin therapy was initiated using a basal-bolus regimen, consisting of insulin glargine 10 units at bedtime and insulin lispro 6 units before meals, adjusted according to blood glucose levels. Supportive care included intravenous normal saline, paracetamol 1 g as needed for pain, and daily sterile wound dressing with antiseptic solution to control local infection.

**Day 2–3:** The patient continued intravenous piperacillin–tazobactam 4.5 g every 8 hours, along with insulin therapy, with frequent monitoring of capillary blood glucose levels. Daily wound care was performed, including cleaning with povidone-iodine and drainage of purulent material. On Day 3, pus culture confirmed Pseudomonas aeruginosa, which was sensitive to piperacillin–tazobactam, ceftazidime, and ciprofloxacin. Based on sensitivity results, the same antibiotic regimen was continued. The patient showed mild clinical improvement, with reduction in fever and slight decrease in tenderness, although discharge from the sinus persisted.

**Day 4–5:** During this period, the patient was prepared for surgical debridement. Glycemic control was optimized by adjusting insulin doses, with insulin glargine increased to 14 units at bedtime and pre-meal insulin titrated based on glucose monitoring. Intravenous antibiotics were continued to reduce bacterial load. The patient underwent pre-anesthetic evaluation, and vital parameters were stabilized. Local wound care was maintained daily. Radiological findings, including sequestrum formation and necrotic bone, indicated that medical therapy alone would be insufficient, necessitating surgical intervention for complete removal of infected and devitalized tissue.

**Day 6:** The patient underwent surgical debridement under general anesthesia. Necrotic bone and purulent material from the right parietal region were thoroughly removed. The surgical site was irrigated with normal saline and antiseptic solution. Postoperatively, intravenous piperacillin–tazobactam 4.5 g every 8 hours was continued to control residual infection. Analgesia

was provided using paracetamol 1 g intravenously every 8 hours as needed. Strict aseptic wound care was maintained. The procedure was completed successfully without complications, and adequate drainage was ensured to prevent accumulation of infected material.

**Day 7–10:** Following surgery, the patient continued intravenous antibiotic therapy with piperacillin–tazobactam 4.5 g every 8 hours. Daily wound dressing was performed under sterile conditions, and the surgical site showed gradual improvement with reduced discharge. Pain was effectively managed with paracetamol and occasional use of tramadol 50 mg for moderate pain. Blood glucose levels were closely monitored, and insulin doses were adjusted accordingly to maintain levels within target range. The patient showed significant clinical improvement, with reduction in swelling, absence of fever, and better general condition.

**Day 11–14:** The patient completed a full 14-day course of intravenous piperacillin–tazobactam. By this stage, there was marked clinical improvement, with resolution of pain, absence of discharge, and healing of the surgical wound with healthy granulation tissue. Laboratory parameters, including leukocyte count and inflammatory markers, showed normalization trends. Glycemic control improved with continued insulin therapy. No complications such as abscess formation or neurological involvement were observed. The patient was clinically stable and deemed fit for transition to oral antibiotic therapy.

**Day 15:** At discharge, the patient was prescribed oral ciprofloxacin 500 mg twice daily for 4 weeks to ensure complete eradication of infection. Insulin therapy was continued with a modified regimen, and the patient was educated on self-monitoring of blood glucose and adherence to medication. Wound care instructions were provided, along with advice on maintaining hygiene. Dietary modifications were recommended to support glycemic control. The importance of completing the antibiotic course and attending follow-up visits was clearly explained to prevent recurrence.

## FOLLOW-UP AND OUTCOME

The patient was followed up regularly at 3 weeks, 6 weeks, and 3 months after discharge. At the first follow-up, there was marked clinical improvement with complete resolution of pain and absence of purulent discharge. The surgical wound showed healthy granulation tissue and progressive healing without signs of reinfection. By the 6-week visit, the wound had healed completely, and the patient remained asymptomatic. Oral ciprofloxacin therapy was completed as prescribed, with good tolerance and no reported adverse effects. Glycemic control improved significantly with adherence to insulin therapy and dietary modifications. At 3 months, laboratory parameters normalized, and HbA1c reduced to 7.2%. Repeat imaging demonstrated no residual infection and evidence of bone healing. No recurrence or complications were observed, indicating successful long-term clinical and radiological outcome.

## DISCUSSION

Chronic skull osteomyelitis is an uncommon but serious infection, particularly in patients with poorly controlled diabetes mellitus. In the present case, the patient exhibited classical features such as progressive scalp swelling, sinus discharge, and low-grade fever. Diabetes significantly contributes to susceptibility due to impaired immunity and reduced vascularity. Similar observations were reported by Conde-Díaz et al.**,** who described skull base osteomyelitis predominantly affecting diabetic individuals with Pseudomonas aeruginosa infection. Likewise, Dusini et al. (2025) emphasized that elderly diabetic patients are at higher risk and often present with delayed diagnosis due to subtle clinical features. These findings correlate with our case, where delayed presentation and chronic progression were evident, highlighting the importance of early suspicion in diabetic patients.[9,10]

Radiological imaging plays a key role in diagnosis and disease assessment. In this case, CT revealed osteolytic lesions with cortical destruction, while MRI demonstrated marrow edema without intracranial extension. These findings are consistent with previous reports. Lee et al. described similar CT findings of bony erosion and emphasized the importance of imaging in identifying disease extent. Additionally, Mammarella et al. (2024) reported that MRI is highly sensitive for detecting soft tissue involvement and early marrow changes, which may not be evident on CT. Our findings align with these studies, reinforcing that combined CT and MRI imaging is essential for accurate diagnosis, differentiation from malignancy, and evaluation of complications.[11,12]

Microbiological confirmation remains the cornerstone of diagnosis and targeted therapy. In the present case, Pseudomonas aeruginosa was isolated, which is the most common pathogen associated with skull osteomyelitis in diabetic patients**.** Caldas et al**.** highlighted that Pseudomonas infections are frequently seen in immunocompromised individuals and can lead to severe complications if untreated. Similarly, Hakeem et al**.** reported that bacterial identification is crucial as the condition may present atypically and mimic other serious diseases such as meningitis. The findings in our case are consistent with these studies, emphasizing the need for culture-based diagnosis and antibiotic sensitivity testing to guide appropriate therapy.[13,14]

Management of chronic skull osteomyelitis requires a multidisciplinary approach involving prolonged antibiotic therapy and surgical intervention when necessary. In our case, the patient responded well to intravenous piperacillin–tazobactam followed by oral ciprofloxacin along with surgical debridement. Baharoon

et al. (2022) demonstrated that delayed or inadequate treatment can lead to life-threatening complications such as meningitis. Furthermore**,** Kim et al**.** reported successful outcomes with combined medical and surgical management, particularly in diabetic patients. These findings support our treatment approach, highlighting that early diagnosis, appropriate antimicrobial therapy, surgical debridement, and strict glycemic control are essential for achieving favorable outcomes and preventing recurrence.[15,16]

## CONCLUSION

Chronic skull osteomyelitis is a rare but potentially serious condition that requires a high index of clinical suspicion, especially in patients with poorly controlled diabetes mellitus. This case highlights the importance of recognizing persistent scalp swelling and discharging sinus as warning signs of underlying bone infection. Early diagnosis through appropriate imaging and microbiological confirmation is essential for timely management. A combined approach involving culture-guided prolonged antibiotic therapy and surgical debridement plays a crucial role in achieving favorable outcomes. Additionally, strict glycemic control significantly influences healing and reduces the risk of recurrence. Prompt and multidisciplinary management can prevent complications such as intracranial spread, thereby improving patient prognosis and quality of life.

### Informed Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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